W9132T-05-R-0028

LOGANEnergy Corp.

Kaolin Field
Sandersville, GA FAA Communications Facility
PEM Demonstration Project
Initial Project Report

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY04

Federal Aviation Administration, Atlanta, GA

15 January 2006

Executive Summary

Under terms of its FY'04 DOD PEM Demonstration Contract with ERDC/CERL, LOGANEnergy will install and operate a Plug Power GenCore 5kWe standby fuel cell power plant at the Sandersville, GA, Kaolin Field, FAA communications center for one year. The unit will be attached directly to the facility's DC bus to enhance critical power availability. However, the system will also be configured to independently test and evaluate the reliability of the GenCore without diminishing its utility. The FAA will not bear any cost burden in the project.

The FAA POC for this project is:

Mr. Rayford M Ryle
US Federal Aviation Administration
SOUTHERN REGION HEADQUARTERS
1701 Columbia Avenue
College Park, GA 30337
Bus: (404) 305-6586
Bus Fax: (404) 305-6285
ray.ryle@faa.gov

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Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced PEM Fuel Cells in Military Facilities

1.0 Descriptive Title

LOGANEnergy Corp. Small Scale PEM 2004 Demonstration Project at Sandersville, GA, Kaolin Field FAA communications facility.

2.0 Name, Address and Related Company Information

LOGANEnergy Corporation

1080 Holcomb Bridge Road
BLDG 100- 175
Roswell, GA 30076
(770) 650- 6388

DUNS 01-562-6211
CAGE Code 09QC3
TIN 58-2292769

LOGANEnergy Corporation is a private Fuel Cell Energy Services company founded in 1994. LOGAN specializes in planning, developing, and maintaining fuel cell projects. In addition, the company works closely with manufacturers to implement their product commercialization strategies. Over the past decade, LOGAN has analyzed hundreds of fuel cell applications. The company has acquired technical skills and expertise by designing, installing and operating over 30 commercial and small-scale fuel cell projects totaling over 7 megawatts of power. These services have been provided to the Department of Defense, fuel cell manufacturers, utilities, and other commercial customers. Presently, LOGAN supports 30 Carbonate, PAFC and PEM fuel cell projects at 21 locations in 12 states, and has agreements to install 15 new projects in the US and the UK over the next 18 months.

3.0 Production Capability of the Manufacturer

Plug Power manufactures a line of PEM fuel cell products at its production facility in Latham, NY. The facility produces three lines of PEM products including the 5kW GenSys5C natural gas unit, the GenSys5P LP Gas unit, and the GenCor 5kW standby power system. The current facility has the capability of manufacturing 10,000 units annually. Plug will support this project by providing remote monitoring, telephonic field support, overnight parts supply, and customer support. These services are intended to enhance the reliability and performance of the unit and achieve the highest possible customer satisfaction. Vinny Cassala is the Plug Power point of contact for this project. His phone number is (518) 782-7700 ex 1228, and his email address is vincent_cassala@plugpower.com.

4.0 Principal Investigator(s)

Name	Chris Davis	Keith Spitznagel
Title	Chief Operating Officer	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388	860.210.8050
Fax	770.650.7317	770.650.7317
Email	cdavis@loganenergy.com	kspitznagel@loganenergy.com

5.0 Authorized Negotiator(s)

Name	Chris Davis	Keith Spitznagel
Title	Chief Operating Officer	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388	860.210.8050
Fax	770.650.7317	770.650.7317
Email	cdavis@loganenergy.com	kspitznagel@loganenergy.com

6.0 Past Relevant Performance Information

a) Contract: PC25 Fuel Cell Service and Maintenance Contract #X1237022
Merck & Company
Ms. Stephanie Chapman
Merck & Company
Bldg 53 Northside
Linden Ave. Gate
Linden, NJ 07036
(732) 594-1686

Four-year PC25 PM Services Maintenance Agreement.
In November 2002 Merck & Company issued a four-year contract to LOGAN to provide fuel cell service, maintenance and operational support for one PC25C fuel cell installed at their Rahway, NJ plant. During the period, the power plant has operated at 94% availability.

b) Contract: A Partners LLC Commercial Fuel Cell Project Design, Installation and 5-year service and maintenance agreement on 600kW UTC PC25 power block.
Contract # A Partners LLC, 12/31/01

Mr. Ron Allison
A Partner LLC
1171 Fulton Mall
Fresno, CA 93721
(559) 233-3262

c) Contract: At Gulfport, MS U.S. Navy facility, executed a service contract to maintain a 200 kW PC25 phosphoric acid fuel cell power plant.

Reliant Energy
PO Box 4300
Houston, TX 77210-430
(713) 207-6199

7.0 Host Facility Information

The Sandersville Airport, pictured in Figures 1 and 2 is the location for the reliability testing of a Plug Power GenCore 5kW standby fuel cell. The publicly owned airport, also known as Kaolin Field, is supported by the FAA southern region in Atlanta, GA and serves Washington County, GA. Sandersville is located in east central Georgia approximately 30 miles east of Macon, GA on state highway 24. Kaolin Field is an uncontrolled airport managed by a local Fixed Base Operator and has a 5,500 runway.

Figure 1: Overhead Photo of Kaolin Field Sandersville, GA

Figure 2: Location of Sandersville GA airport and OKZ Station Identifier

8.0 Fuel Cell Site Information

Located near Kaolin Field, but remote from airfield operations, is an FAA Remote Communication Air/Ground (RCAG) facility which is part of the regional and national system that provides a means of communication between pilots and air traffic controllers.

The approximately 60'x60' area around the facility is secured by a chain link fence with gate access on the south side. The small building and the tower located near the south wall of the building are on concrete pads. The remaining area inside the fence is gravel surface. The perimeter area immediately outside the fence is unfinished surface but generally appears to be passable by vehicle.

The photos in Figure 3 above are the communications facility that will host the Plug Power GenCore 5kW standby fuel cell unit.

The GenCore unit will sit on a new concrete pad between the perimeter fence and the east side of the communications building. The 20.5' of space between the fence and building will provide adequate clearances and working space around the fuel cell.

Figure 3: FAA Communication Tower

Present plans are to locate the metal enclosure containing the (standard industrial gas) bottles of hydrogen outside of the existing perimeter fence. This will permit access for hydrogen fuel delivery by the local industrial gas supplier without the need to enter the fenced FAA secure area. Access to the hydrogen cabinet (outside the security fence) will be controlled by installing new fencing with a separate gate (and key) access.

Figure 4: Communications Facility at Kaolin Field

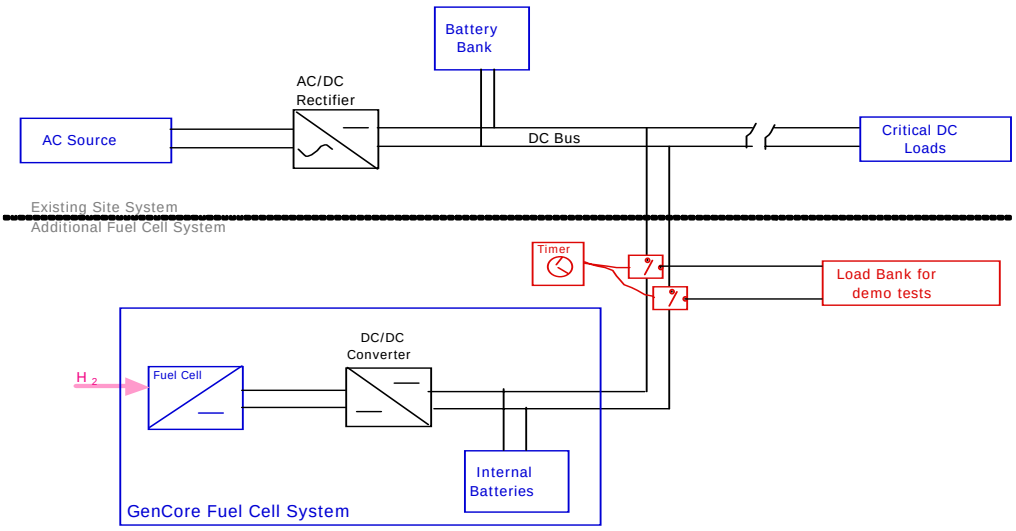
9.0 Electrical System

Grid power to this facility is supplied via overhead distribution and an overhead service drop to the building. Backup power to the critical loads is supplied by two small banks of lead acid batteries. The batteries supply a +48 volt DC bus that supports the loads.

The Plug Power GenCore 5kW PEM standby fuel cell power plant selected for this project will provide +48 volt DC power to the communications equipment bus located in the facility pictured in Figure 4. When the fuel cell is connected to the DC bus, the existing system will function just as it currently does without a fuel cell. However, as a grid outage continues, the existing backup batteries will begin to deplete; causing the bus voltage to lower which will trigger the fuel cell to start. With the fuel cell on-line, the 48 volts on the bus will be maintained (and the batteries charged) so long as the fuel cell continues to operate.

Figure 5: Critical DC Loads

Figure 5 is a photo of the UPS equipment currently in use at the facility that will be supported by the GenCore. Figure 6 depicts an electrical diagram of the existing system and the additional fuel cell electrical connections.



During normal operation when AC power is available, the fuel cell is not producing power. The fuel cell's internal batteries are charged from the DC bus.

During an AC power outage, the bus voltage gradually drops which triggers the fuel cell to start. The fuel cell will then maintain the DC bus voltage including charging of the batteries so long as hydrogen is supplied or until the AC power is restored.

Components in red are included for testing purposes as required under the CERL demonstration program.

A timer will periodically open the double throw contactors; disconnecting the fuel cell system from the DC bus and connecting to a load bank. The absence of the DC bus voltage will cause the fuel cell to start and supply power to the load bank until the timer reconnects to the DC bus.

Figure 3: DC Connection Line Diagram

10.0 Thermal Recovery System

Thermal recovery will not be a part of this project.

11.0 Data Acquisition System

Per the requirement for CERL demonstrations, data will be collected to determine compliance with the required 90% availability. For a backup power application such as Sandersville, this means the fuel cell must start for at least 90% of the events when called upon. Since it is unlikely that actual grid outages will be frequent enough to test the fuel cell response, relays will be installed to automatically (and with no disruption to the DC bus) disconnect the fuel cell from the bus and trigger the fuel cell to start off-line from the FAA bus. Plans for the automated testing call for the fuel cell to start 3 times per day for 6 day per week. For the daily startups, the fuel cell will run 15,10, and 10 minutes. One day per week the fuel cell will run for 60 minutes.

LOGAN proposes to install a multi-channel datalogger to record the necessary activity and data. For communication with the data acquisition system, a telephone line will be needed. A separate phone line is preferred to sharing the existing phone line at the site.

12.0 Economic Analysis

Kaolin Field, Sandersville GA FAA Communications Facility PEM Project

Project Utility Rates				
1) Water (per 1,000 gallons)				
2) Utility (per KWH)Ź				
3) Hydrogen (per bottle)	$ 50.00			
First Cost			**Estimated**	**Actual**
Plug Power 5 kW SU-1			$ 14,250.00	
Shipping			$ 1,500.00	
Installation electrical			$ 4,225.00	
Communications package			$ 1,800.00	
Testing controll package			$ 2,250.00	
Site Prep, labor materials			$ 450.00	
Technical Supervision/Start-up			$ 1,750.00	
Total			**$ 26,225.00**	
Assume Five Year Simple Payback			$ 5,245.00	$ -
Forcast Operating Expenses	Volume	$/Hr	$/ Yr	
Hydrogen	-	-	$ 2,587.00	
Service			$ 1,000.00	
Total Annual Operating Cost				$ 3,587.00
Economic Summary				
Forcast Annual kWH		301		
Annual Cost of Operating Power Plant		$ 11.91	kWH	
Project Net Operating Cost		$ 11.91	kWH	

13.0 Kickoff Meeting Information

The project kick-off meeting is tentatively scheduled to occur on February 16th at 9:00 AM EST by teleconference. At that time CERL, LOGAN and FAA representatives will conference to discuss the purpose, scope, and conduct of the PEM demonstration project. The teleconference will identify any issues to be resolved prior to beginning the installation of the fuel cell.

14.0 Status/Timeline

See Appendix Section 2.

Appendix Sections:

1. Fuel Cell Specifications
2. Installation Site Line Diagram
3. Project Schedule and Timeline

Appendix Section 1

Plug Power GenCore Specifications

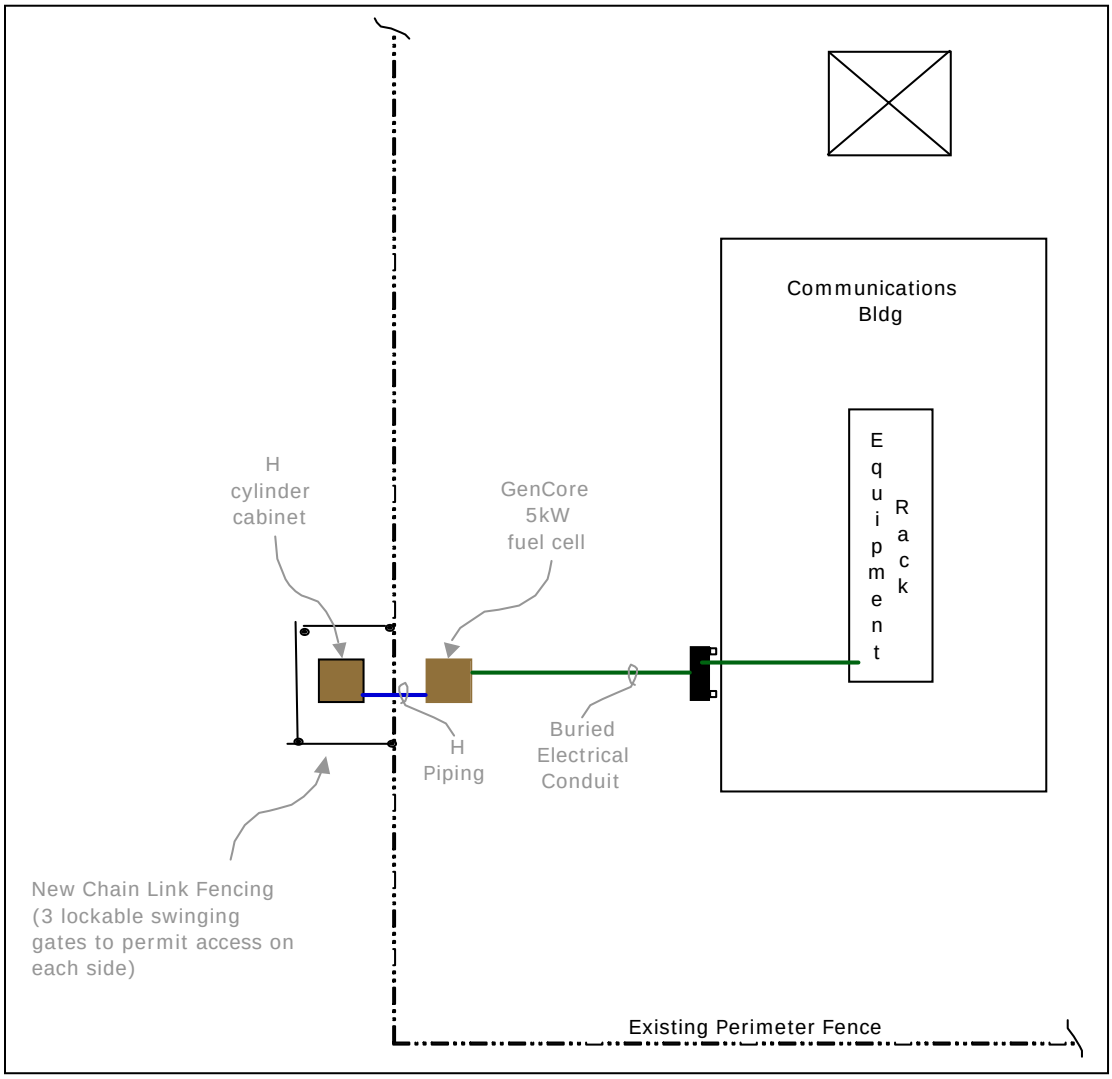
PRODUCT CHARACTERISTICS			
Performance	Net Output[1]	0 to 5,000W	✓
	Adjustable Voltage Output	– 46Vdc to –56Vdc	–
		+46Vdc to +56Vdc	✓
	Operating Range – Voltage	– 42Vdc to – 60Vdc	–
		+42Vdc to +60Vdc	✓
	Operating Range – Current	0 to 109 Amps	✓
Fuel	Gaseous Hydrogen	99.95% (dry)	✓
	Supply Pressure	70 +/- 10 psig	✓
	Fuel Consumption	40 slm at 3,000W	✓
		75 slm at 5,000W	✓
Operation	Ambient Temperature	-40C to 46C	✓
	Relative Humidity	0% to 95% non-condensing	✓
	Altitude	-197ft to 6,000ft	✓
Physical	Dimensions	44" x 26"W x 24"D	✓
	Weight	500Lbs	✓
Safety	Compliance	FCC Class A	✓
		ANSI Z21.83	✓
		UL	✓
		Telcordia GR 63, 78,487, 1089	–
Emissions	Water	Maximum 2.0 liters per hour	✓
	Co, CO2, NOx, SOx	<1ppm	✓
	Audible Noise	60dba @ 1m	✓
Sensors	Gas Hazard Sensor		✓
	Pad Shear		○
	Water Intrusion		○
	Tampering		○
Control	Microprocessor w/Diagnostics		✓
	2 LED Alarm Panel		✓
	Communications	RS-232	✓
		Digital Form "C" output	✓
		Modem	○
		Ethernet	○

[1]Rating applies for altitudes up to 1,000ft

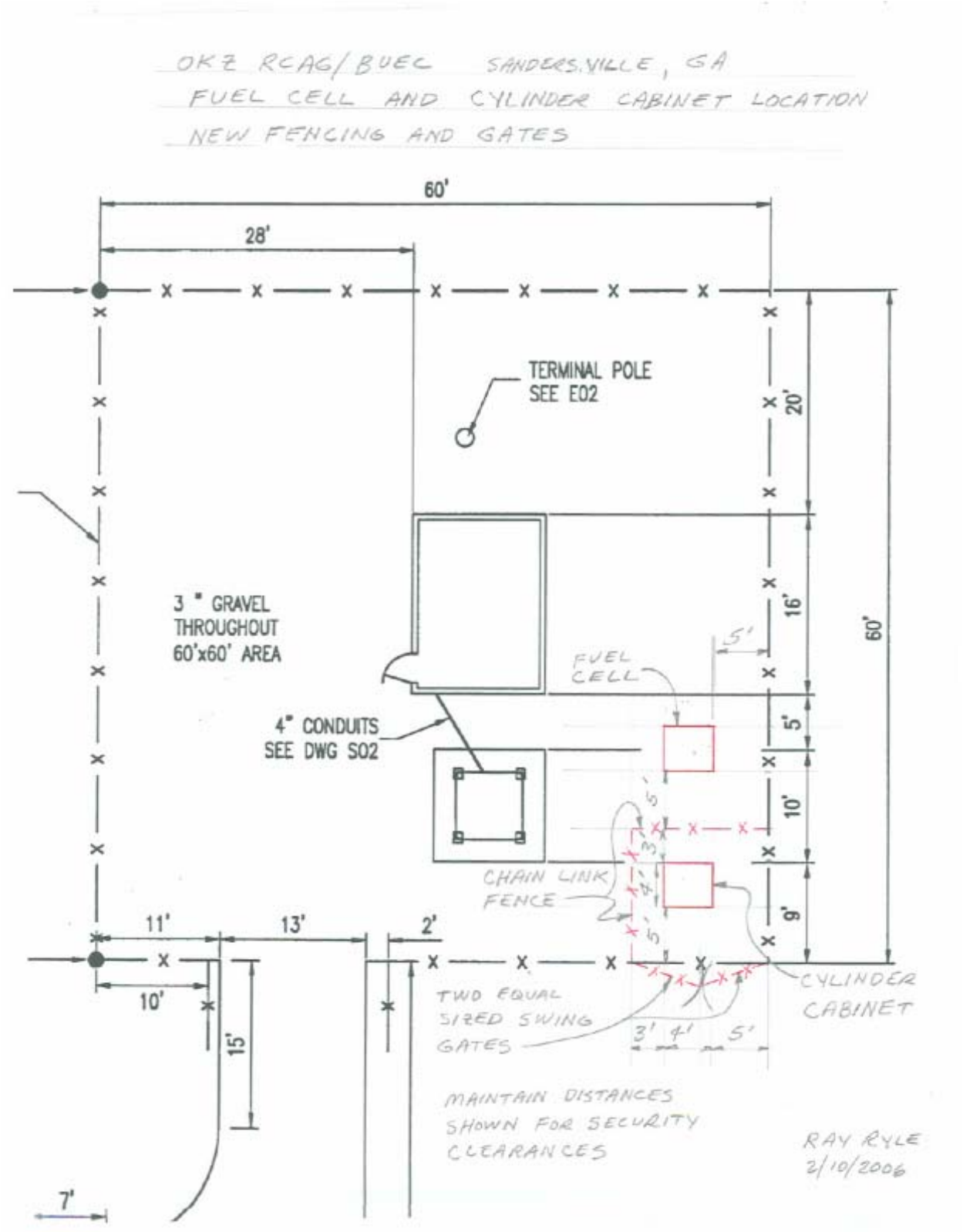
Example GenCore Installation

Appendix Section 2

Installation Site Line diagram



Revised FC Location Diagram
Feb 2006



Appendix Section 3

Project Schedule

Kaolin Field, Sandersville, GA FAA Communications Facility

Installation, Monitoring, Performance Evaluations, & Reporting on One Plug Power PEM Fuel Cell

Column Headings Indicate the Beginning of Each Month

Installation Schedule